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Slum Upgrading Programs and Disaster Resilience: A Case Study of an Indian 'Smart City'

Jessica Yu[a,*], Harry Shannon[b], Andrea Baumann[b], Lisa Schwartz[b], Mihir Bhatt[c]

[a]*University of British Columbia, 2329 West Mall, Vancouver, BC V6T 1Z4, Canada*
[b]*McMaster University, 1280 Main St W, Hamilton, ON L8S 4L8, Canada*
[c]*All India Disaster Mitigation Institute ,411 Sakar Five, Ahmedabad – 380009, Gujarat, India*

Abstract

Analytical literature on the exact link and nature of problems faced by the urban poor due to climate change and disasters is scarce. The objective of this research is to identify slum residents' current disaster management (DM) strategies, their perceived needs, and preferences for infrastructural upgrades. Twenty-four in-depth interviews and nine focus groups were conducted with community members in seven different communities in Ahmedabad, India. One important finding was that some physical and non-physical infrastructure needs were not considered in traditional slum upgrading strategies. Implications of these findings can be considered for DM strategies and for Sustainable Development Goal #11.

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Keywords: Disaster resilience; Slum upgrading programs; Healthy cities; Urban poor; Sustainable development goals; Disaster management

1. Introduction and Background

Disasters can destroy years of effort and labour, further perpetuating poverty for the poor and most vulnerable[1-2]. Even if disasters *turn back the development clock*, they are rarely ever included within urban development strategies[3], despite the fact that the World Bank's Disaster Management Facility has stated the need to mainstream disaster mitigation into development practice[4]. Disasters can erase the benefits of development as much

* Corresponding author. Tel.: +1604 822 8952.
E-mail address: jessica_yu@alumni.ubc.ca

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as poorly planned development can become a source of hazard; gaps between disasters and urban planning need to be closed and more proactive measures are needed to reduce the threat of disaster[3, 5].

The urban poor end up more directly exposed to natural hazards compared to their wealthy counterparts, even as the cities are overburdened with rapidly expanding populations and limited infrastructure and funds[6]. Urbanization and poverty frequently come up in the discussion, as stresses that amplify the risks that people face from the effects of climate change[7-8]. The urban poor are particularly vulnerable to flooding, often due to clogged drains, land subsidence, heat waves, and increased health risks. However, Baker's report on Climate Change, Disaster Risk, and the Urban Poor[6] suggests analytical literature on the exact link and nature of problems faced by slum dwellers due to housing issues in the area of disaster risk reduction is scarce. Furthermore, UN-HABITAT's The Challenge of Slums: Global Report on Human Settlement 2003 asserts that NGO's must first come to grips with what slums really are, why they exist, as the people living in slums are projected to double by 2030[9].

As such, disasters and development cannot be seen in isolation of each other and must be holistically studied. Most published research acknowledges that basic services should be provided to improve the living conditions of the urban poor, and that lack of access to these services increases their vulnerability[9-10]. One such example is slum upgrading programs (SUPs), which involve the improvement in the physical environment of an existing slum area such as water, drainage, sanitation, energy, roads, and transportation. A recent systematic review[11] on the different types of in-situ slum upgrading strategies showed limited but consistent evidence that slum upgrading can reduce incidence rates of diarrhoea and water-related expenses for slum dwellers. However, other studies[12-14] have advocated for more holistic and participatory slum improvement approaches, whereby SUPs could include social, economic, and political components. To date, SUPs have not kept pace with the growing ranks of the urban poor and the number of qualitative case studies of slum upgrading is limited[9].

Other similar case studies in informal communities in India[7] and Bangladesh[15-16] have been conducted; the authors advocate for hazard scholars to find innovative strategies to improve disaster resilience in low-income communities in developing countries. As shown, more empirical research is needed to identify the urban poor's current preparation and mitigating strategies, perceived needs, and preferences for infrastructural upgrades. Furthermore, evidence on the effectiveness of SUPs to prepare and mitigate for the effects of a disaster, to date, has not been examined; can slum upgrading be used as a mean of disaster preparation or to enable slum communities to "build back better"[17]? We will report on a study whose aim was to address the gap in literature between increasing urbanisation and the implications for the urban poor in DM plans in India and beyond.

2. Methodology

In this study, qualitative descriptive and case study designs were used to describe the participants' current mitigating strategies, their perceived needs, and preferences for infrastructural upgrades. Early disaster studies developed out of qualitative research case study designs because it allowed researchers to discover and portray multiple views of the case[18-19]. Although interviews are subjected to individual bias, recall bias, and poor or inaccurate articulation[20], they are also considered the main roads to multiple realities[19]. Furthermore, focus groups were conducted to examine if any new concepts or themes emerged when participants were in a group setting.

This research was granted approval by the Hamilton Health Sciences Research Ethics Board on May 28, 2014. Ahmedabad was chosen as the site of study due to its multi-hazard profile, which includes natural hazards such as earthquakes, floods, and cyclones. This affects around 7.2 million people who live in the urban centre, of which around 40% live in slums and informal tenements known as chawls[21-21]. To gain access to the different communities, a local non-governmental organisation - All India Disaster Mitigation Institute (AIDMI), Ahmedabad, India – and a local supervisor (from Manipal University) were contacted in the early planning stages. The study's objective, research questions, and setting were discussed to identify potential participants. The eligibility criteria included adults over the age of 18 who had their homes damaged or had to leave their homes for an extended period of time. The study's information letters were given to local advisors to use for recruitment in the study.

Twenty-four interviews and nine focus groups discussions (FGDs) were conducted over a six-week period.

To ensure that the interviews would be locally and culturally appropriate, the interview guides were reviewed with local advisors (supervisory committee members and AIDMI). The guides were semi-structured and the themes of the interviews were determined ahead of time (see **Table 1**). The interviews ranged from 15 minutes to 1 hour.

Table 1. Thematic topics and examples of interview questions.

Thematic Topics	General Questions	Probing Questions
Disaster guidelines awareness levels	What do you do to prepare for natural disasters like floods and earthquakes?	•Can you explain what you must do if there is a flood? How about if there is an earthquake? •Did you learn about what to do because the government helped you? If so, how did they help you? •What do you think you could do to your home to prepare for floods or earthquakes? •Where in the community (neighborhood) can you get information on what to do to prepare for a flood or an earthquake?
Physical Housing Upgrades / Land Tenure Status	Where do you live and who do you live with?	•Do you own your home? If not, how does this affect you? •Do you think you need to make changes for your home? If so, what are they? Which ones are the most important for you?
Social needs before and after a disaster	How were you affected by the last flood? For example, did it hurt you, your friends, or your family? Did it change how you feel about yourself or your home? Did it cost you a lot of money?	•Who do you trust to help you when there is a flood? •Did the last flood (in September 2013) change your friends and family and the way they live?
Perceptions of government and community disaster resilience	Did the government do anything for your community (neighbors and friends) to prepare for a flood? Did the government do anything for you to help after a flood?	•What kind of changes to your home did the government help with? What kinds of changes did you do for yourself? •Are there any groups in the community that you can join to speak to the government about what you need?

The communities were chosen based on advice from a local organisation (All India Disaster Mitigation Institute). Seven different communities were chosen to provide an equal representation of Ahmedabad's slum community members from both the East and West part of the city (within the corporation's limits) with a range of different religions, cultures, and occupations. Meetings were held with home owners and community leaders whenever possible. All interviews were performed in the local dialect (Gujarati) with the help of a local interpreter and translated to English. All interviews were recorded with hand written field notes.

As this study's aim was to provide knowledge, new insights, and a practical guide to action, inductive content analysis was recommended[23]. The steps that were taken include: 'open coding', 'creating categories', and 'abstraction'. The transcripts and field notes were scanned through several times, highlighted and colour coordinated based on different codes. In addition to handwritten notes, a qualitative data analysis software package (NVivo 10, QSR International Inc., Burlington, MA, USA) was used to manage the volume of data and facilitate in the development of emergent codes. The process of coding and memoing were done iteratively throughout the data collection and analysis processes.

The interviews were coded based on the connections with the research questions to develop preliminary findings under themes. The themes included *urbanization*, *planning*, and *networking*, which were developed from the data and informed by existing literature. In order to ensure rigour in the study, this case study endorsed Lincoln and Guba's framework[24] of *credibility*, *dependability*, *confirmability*, and *transferability*.

3. Findings

As described in the summary of the findings below, many of these infrastructural strategies are learned from living in a state historically burdened by extreme natural hazards. What will be shown is that the disaster mitigation actions taken by the community members (CMs) will depend on the physical, social, and political structures in place.

Current Disaster Management Strategies and Infrastructural Preferences

Protection from Water Leakages: Water leakages were a recurring response in almost all interviews and focus group discussions. This particular problem faced in Ahmedabad is often associated with the tropical monsoon season. Thus, many of the strategies employed for potential future disasters begins with making structural and shelter adaptation for more short-term, immediate water leakage problems during periods of heavy monsoonal rain. This includes putting plastic sheets on the roofs of their homes and flooring (see **Fig. 1a**), tying the roof with wood pillars, using both stones and plastic sheets together to hold down the roofs (see **Fig. 1b**), seasonal checks for roof repairs, and if the financial resources permit, building a terrace and a porch. The most common approach found with the respondents was the use of plastic sheets as it is an inexpensive modification; CMs have mentioned that it cost them between 500-3000 rupees (approx. USD$8 – USD$50) to purchase these plastic materials. Although the solution was often temporary, plastic sheets are still more affordable than building an extra story, terrace, or veranda that are more desired by many of the CMs interviewed.

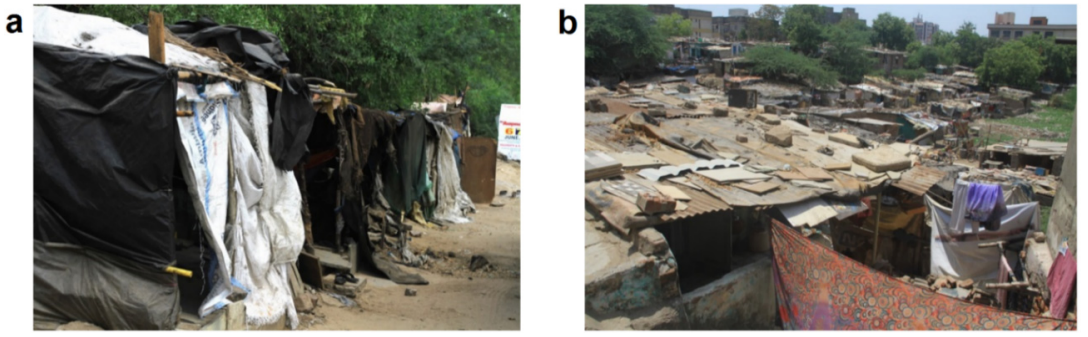

Fig 1. (a) Photo of plastic sheets commonly used to shelter from heavy rainfall and water leakages; (b) Photo of stones and other materials used to hold metal sheet (roofs) down.

Individuals cleaning Community Drainage Problems: Drainage issues surface in many of the discussions in the interviews and focus groups. As many residents noted the insufficient help from the governments in clearing neighbourhood drainages, others have made it their own personal task to clean out the drainages near their homes so the flood water, often mixed with waste, does not flow into their own space. Furthermore, it has been suggested that raising the flooring and the veranda can help prepare for the monsoon season (see **Fig. 2a**). In general, despite preparation measures for these community drains from water logging, there were reports that the problems persist in the event of a natural disaster or extreme rainfall. This shows that although community drains can mitigate some of the effects of water logging, there are still limits to the capacity of the current overall drainage system in Ahmedabad, affecting both the urban poor and the urban non-poor.

Storage of Livelihood Goods: Since there are indirect household damages from water logging and leakages, some residents do not store "food grain" or household items on the floor as water leaks from the roof and damage many of their goods. In fact, the history of storing food grain is a strategy employed by the urban poor. Whenever the residents earn more income during one part of the year than others, they store food grains. When earnings are less, the stored food grain is consumed. This provides a method for survival and self-employed financial protection scheme. On one hand, this preparation strategy prevents livelihood losses during water leakages and flooding. On the other hand, the urban poor lose out on their own form of financial protection mechanism, used to offset the

vulnerability from living in a shelter that is not made to cope with extreme weather.

Extreme Heat: Use of Fans and Shade: To prevent health effects of heat, the most common methods have been to use a fan, take more frequent baths, sit in the open area/under a tree and in a shade, and spray water on the ground floor for a 'cool feeling'. However, some residents cannot use fans when there is no electrical power supply in their homes. Only one resident (CM from FGD1) mentioned putting cotton material on top of their 'iron roofs' to cope with the heat, while another participant of a focus group believes that another story could reduce the heat inside their home. With the newly-instated Heatwave Action Plan 2014[25] in Ahmedabad, there was some interest on whether there was any translation of the guidelines. However, none of the participants were aware of this particular strategy. Some members of FGD1 responded that, '*only the newspaper tells (us) how hot it is – there are no (specific) preparations for the heatwave.'*

Structural Adaptations for Earthquakes: Residents with *concrete* shelters or *pucca* (permanent) houses are, on the whole, not as concerned with the danger of earthquakes as residents in more *kutcha* (temporary) housing. CMs described that kutcha housing needed a stronger foundation, cemented walls (see **Fig. 2b***),* or soldered electrical circuits. One focus group agreed that they need to secure their homes with brick walls and construct pillars to prevent the house from collapsing. However, CMs often felt they had to make trade-offs based on upgrades to deal with both concerns of heat stresses and earthquakes.

Fig. 2. (a) Photo example of how the lack of a good foundation, porch or veranda can cause water leakage issues when the water from the community flows into individual housing units; (b) Photo showing that concrete walls are desired for 'earthquake-proof homes', but concerns are made by some CMs that these homes cannot protect from heatwaves.

Disaster Management Resource Centres: When asked where information for disaster preparation or mitigation has been collected, almost all residents said that there is no community resource centre to collect information – most have learned from their own experiences. Only one resident (CM #7) had received disaster training from a local NGO, and responded that it was for this reason he made these structural adaptations for his home. Other respondents noted that they receive disaster information from the television or radio, but many rely on the community response to let them know if there is a disaster. In fact, the importance of the community response was noted:

> "No information was given to me by the government. I use my own thinking and look at what (my) neighbours are doing." (CM #1)

Most interviewees responded that they did not receive any training from a community resource centre, government or NGO programs; they use more popular formats such as the television, radio, newspaper, and endorsed more *self-help* models.

Political Representation for Community Problems: Most of the slum communities form small "unofficial" groups to express their community problems. The problem has been articulated numerous times that the response from the government is usually slow and a lot of issues stay unresolved. As a result, many of the participants rely on the community leader to voice out their problems, as it is seen to be instrumental and helpful in facilitating dialogue

with government officials. However, two community leaders interviewed, CM #20 and #21, mentioned the success of "official" groups, each with 11 and 13 elected neighbourhood representatives, respectively. CM #20 even mentioned about how he inspired three other slum communities to create groups; the benefits to forming such groups were noted:

> "If you have (an official) group, your voice will be trusted by other organizations and governments. They will gain awareness of the issues and the community will be united. Your voice will be stronger. (The group) will be protected by the government side to solve the issue." (CM #20)

Overall, it was implied that more community structural upgrades were done for slums with official self-formed political groups, which resulted in fewer community issues raised in the interviews, such as drainages and inadequate sewage lines.

4. Discussion

In summary, the CMs interviewed use various official and unofficial methods to prepare for disasters. There were strategies that used physical infrastructural changes to help mitigate some of the water leakages, heat stressors, or to prepare for other future natural hazards. There are also non-infrastructure strategies that can be used, such as having high social capital, which is described in this context as having personal support networks and community-building activities. Similar to the findings in the Mumbai[7] and Dhaka[15-16], the social capital provided non-financial support for the CMs in the event of a flood. However, the communities in Ahmedabad also used their self-formed groups and networks to identify collective problems and implement government-assisted interventions. These preparation strategies are necessary given the extent of the resources available to the residents. Thus, an integrated DM plan for the urban poor is necessary given the extent of the resources available to them, which should include the combination of both physical infrastructural changes and capacity-building of social and political rights.

Most CMs must make constant trade-offs based on the resources available to them and their decisions depend on the way they prioritize and frame the problems; these trade-offs reaffirm Turner's concept that *housing is a verb*[26]. There are conflicting ideas of infrastructural upgrades used for disaster resilience– what kind of infrastructural upgrades can be made to protect from multiple hazards? The lack of community resource centres found in this case study reflect the findings of Quarantelli[26] and Wisner[27] - slum dwellers typically do not receive suggestions and consultancies from urban planning and development institutions on different hazard risk reduction techniques in building design.

4.1. New Lens on Slum Upgrading Programs (SUPs)

Baker's report[6] suggests there is a shortage in literature in the area of housing and sector-specific provision of services for disaster risk reduction. Our study goes some way to address this through the lens of the urban poor in Ahmedabad. Effective drainage systems, sewage systems, roads, water lines, roofs, elevated porches, and stronger foundations are some of the shelter and community upgrades needed for DM. These infrastructural changes were also reported by respondents in other case studies[7, 15-16]. Yet some of these features, along with the promise of no eviction guarantees, are included in SUPs (refer to **Fig. 3**). As such, this paper proposes a new framework for consideration – can SUPs (such as the Slum Networking Program in Ahmedabad), often suggested in the literature for slum development, facilitate more disaster-proof urban planning[29]? Basically, can scaling up the SUPs address urban poverty issues in major urban cities as well as address one of the gaps in DM for the urban poor*?* This hypothesis is based on three premises: a) DM and development activities are interconnected, b) SUPs create fewer disruptions of livelihoods than slum relocation, and c) SUPs provide no-eviction guarantees and address issues of land tenure, an important impediment to effective DM strategies.

Lastly, this section considers other elements which can be considered in the SUP (summarized in **Fig. 3**). One of the key findings in this study is the self-formed groups that identify community issues and mobilise the voices of the CMs. Thus, the findings in this case study supported the development of the current recommended model of *participatory slum improvement*[11-13] and this paper advocates for future SUPs to include a combination of

physical infrastructural changes and capacity-building of social and political rights.

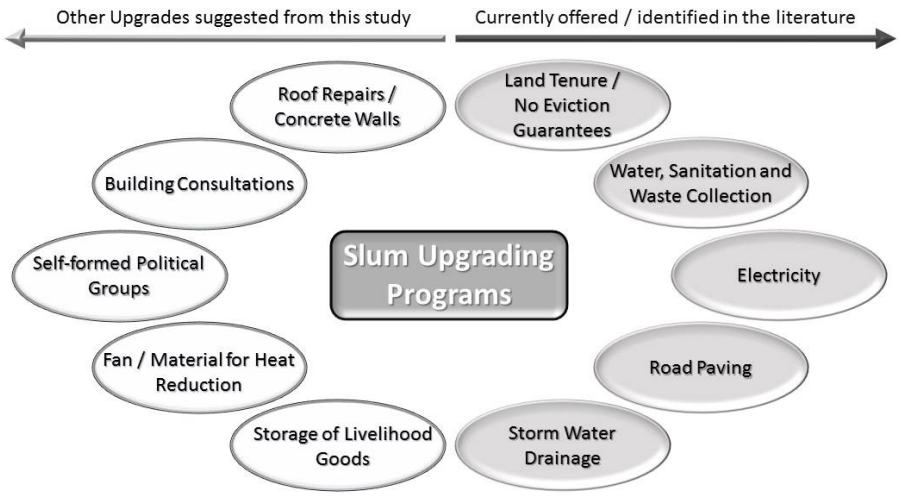

Fig. 3. Summary of the current and proposed features in the Slum Upgrading Programs.

4.2. Strengths and Limitations of the Study

The limitations of this study include the use of field notes instead of verbatim transcripts for some interviews and the collection of primarily verbal reports. Thus, this single case study is a suitable way to obtain specific details that can be used for further evaluations and applied to other cases. Transferability judgements can be made by readers based on the characteristics of the participants, and the general themes raise useful considerations for other contexts. Further studies that use a similar framework and recommendations could validate the findings in this study. Finally, the limitation of the discussion to floods and earthquake was built into the interview guide, and not because other hazards, such as cyclones, were not a concern. The study's strengths come from the use of Lincoln and Guba's criteria[24] for establishing rigour in qualitative studies, including multiple data collection techniques (source and method triangulation), a rich data source (24 in-depth interviews and 9 focus groups), and the partnership with a key local NGO, who helped navigate the city and ensured appropriate cultural considerations.

5. Conclusion

In future studies, more longitudinal studies are needed to evaluate the hypothesis that SUPs can be used for disaster preparation and post-disaster recovery, as well as for poverty alleviation. If the results support this hypothesis, these projects would need to be re-evaluated, prioritised and strategized to address the goals of both the urban development and DM agendas. This is especially important in low- and middle-income countries, such as India, as the slum population is expected to surge from 93 million in 2011 to 104 million in 2017[30].

Recently, the Government of India initiated the Smart Cities Challenge to promote economic growth, strengthen governance, and improve results for urban residents[31]. Ahmedabad is one of the cities to commit to the Smart Cities Challenge. Can Ahmedabad and other major urban cities around the world that are vulnerable to natural hazards re-consider its slum development plans? Further neglect of this already neglected population will not only be costly, but will bring us further away from our international goals, such as Sustainable Development Goal #11: Make cities and human settlements inclusive, safe, resilient and sustainable.

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References

1. Sanderson D, Sharma A, Anderson J. NGO permanent housing 10 years after the Gujarat earthquake: revisiting the FICCI–CARE Gujarat rehabilitation programme. *Environment and Urbanization*. 2012 Apr 1;24(1):233-47.
2. World Bank. Disaster Risk Management; 2014. http://www.worldbank.org/en/topic/disasterriskmanagement/overview
3. Sanderson D. Cities, disasters and livelihoods. *Environment and Urbanization*. 2000 Oct 1;12(2):93-102.
4. World Bank. Building Resilience – Integrating Climate and Disaster Risk into Development. GFDRR; 2013. http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/11/14/000456286_20131114153130/Rendered/PDF/826480WP0v10Bu0130Box37986200OUO090.pdf
5. O'Brien G, O'Keefe P, Rose J, Wisner B. Climate change and disaster management. *Disasters*. 2006 Mar 1;30(1):64-80.
6. Baker JL, editor. Climate change, disaster risk, and the urban poor: cities building resilience for a changing world. *World Bank Publications*; 2012 Apr 1.
7. Chatterjee M. Slum dwellers response to flooding events in the megacities of India. *Mitigation and Adaptation Strategies for Global Change*. 2010 Apr 1;15(4):337-53.
8. Dovers S, Handmer J. *The handbook of disaster and emergency policies and institutions*. Routledge; 2012 Apr 27.
9. U. N. Habitat (2003). The challenge of slums: global report on human settlements 2003. London: Earthscan.
10. Bhan N. Slum upgrading strategies involving physical environment and infrastructure interventions and their effects on health and socio‐economic outcomes. *Journal of Evidence‐Based Medicine*. 2013 Feb 1;6(1):57.
11. Turley R, Saith R, Bhan N, Rehfuess E, Carter B. Slum upgrading strategies involving physical environment and infrastructure interventions and their effects on health and socio-economic outcomes. *Cochrane Database Syst Rev*. 2013 Jan 1;1.
12. Contractor Q. Understanding the impact of involuntary slum resettlement on women's access to healthcare in Mumbai, India. *Journal of Comparative Social Welfare*. 2008 Oct 1;24(2):153-63.
13. Das AK, Takahashi LM. Evolving institutional arrangements, scaling up, and sustainability emerging issues in participatory slum upgrading in Ahmedabad, India. *Journal of Planning Education and Research*. 2009 Dec 1;29(2):213-32.
14. Majale M. Employment creation through participatory urban planning and slum upgrading: The case of Kitale, Kenya. *Habitat International*. 2008 Jun 30;32(2):270-82.
15. Aßheuer T, Thiele-Eich I, Braun B. Coping with the impacts of severe flood events in Dhaka's slums—the role of social capital. Erdkunde. 2013 Jan 1:21-35.
16. Jabeen H, Johnson C. Perceptions of climate variability and coping strategies in informal settlements in Dhaka, Bangladesh. InCities at Risk 2013 (pp. 149-170). Springer Netherlands.
17. Clinton, W.J., 2006. Lessons learned from tsunami recovery: Key propositions for building back better. New York: Office of the UN Secretary-General's Special Envoy for Tsunami Recovery.
18. Phillips BD. Qualitative methods and disaster research. *International Journal of Mass Emergencies and Disasters*. 1997;15(1):179-95.
19. Stake RE. *The art of case study research*. Sage; 1995 Apr 5.
20. Yin RK. *Case study research: Design and methods*. Sage publications; 2013 May 7.
21. National Institute of Disaster Management. Gujarat National Disaster Risk Reduction Portal; 2014. http://nidm.gov.in/pdf/dp/Gujarat.pdf
22. Anand, S. Best practices in slum improvement: The case of Ahmedabad, India. Development Innovations Groups (DIG); 2008. http://www.urbisnetwork.com/documents/AhmedabadBestPracticesinSlumImprovement-WUF.pdf.
23. Elo S, Kyngäs H. The qualitative content analysis process. *Journal of advanced nursing*. 2008 Apr 1;62(1):107-15.
24. Lincoln YS, Guba EG. *Naturalistic inquiry*. Sage; 1985 Apr 1.
25. Ahmedabad Municipal Corporation. Ahmedabad Heat Action Plan 2014. Natural Resource Defense Council; 2014. http://switchboard.nrdc.org/blogs/ajaiswal/HAP%202014_FINAL.pdf.
26. Turner JF. Housing as a verb. Freedom to build. 1972:148-75.
27. Quarantelli EL. Urban vulnerability to disasters in developing countries: managing risks. *Building safer cities: the future of disaster risk*. 2003:211-32.
28. Wisner B. Marginality and vulnerability: Why the homeless of Tokyo don't 'count'in disaster preparations. Applied Geography. 1998 Jan 31;18(1):25-33.
29. Wamsler C. Managing urban risk: perceptions of housing and planning as a tool for reducing disaster risk. *Global Built Environment Review*. 2004;4(2):11-28.
30. Times of India. "By 2017, India's slum population will rise to 104 million" 2013. http://timesofindia.indiatimes.com/india/By-2017-Indias-slum-population-will-rise-to-104-million/articleshow/21927474.cms
31. Ministry of Urban Development. "Smart Cities Challenge" http://www.smartcitieschallenge.in/